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Class / Subclass

ISSUE CLASSIFICATION

SCANNED

PROVISIONAL
APPLICATION
NUMBER

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1. Application _____ papers.
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PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

1/1999 SCHAPMAN 00000054 122325 60117186
:114 150.00 CH

PTO-1556
(5/87)
*U.S. GPO: 1998-433-214/80404

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
60/117,186 PROVISIONAL	01/26/99		0000	1-17

APPLICANT

MAHJOUR ALI ABDELGADIR, ORLANDO, FL; GLENN B. ALERS, CHATHAM, NJ; JOSEPH WILLIAM BUCKFELLER, ALLENTOWN, PA; JEFFREY DEVIN BUDE, NEW PROVIDENCE, NJ; SIDDHARTHA BHOWMIK, ORLANDO, FL; JANE P. CHANG, CHATHAM, NJ; SUNDAR SRINIVASAN CHETLUR, ORLANDO, FL; JAMES THEODORE CLEMENS, WATCHUNG, NJ; PHILIP W. DIODATO, ASBURY, NJ; ROBERT MCLEMORE FLEMING, CHATHAM, NJ; GREGG SUMIO HIGASHI, ORLANDO, FL; ISIK C. KIZILYALLI, ORLANDO, FL; JAMES JOSEPH KRAJEWSKI, RARITAN, NJ; MICHAEL MANFRA, SHORT HILLS, NJ; MACRCO MASTRAPASQUA, ANNANDALE, NJ; ALVARO MKAURY, ORLANDO, FL; MARTIN G. MEDER, CATASAUQUA, PA; SAILESH MANSINH MERCHANT, ORLANDO, FL; DONALD WINSLO MURPHY, GREEN BROOK, NJ; LOREN NEIL PFEIFFER, MORRISTOWN, NJ; MICHAEL LOUIS STEIGERWALD, MARTINSVILLE, NJ; HEM M. VAIDYA, ORLANDO, NJ; KENNETH WILLIAM WEST, MENDHAM, NJ; YIU-HUEN WONG, SUMMIT, NJ; SUSAN M. ZAHURAK, LEBANON, PA.

CONTINUING DOMESTIC DATA********
VERIFIED

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371 (NAT'L STAGE) DATA********
VERIFIED

_____

FOREIGN APPLICATIONS********
VERIFIED

_____

FOREIGN FILING LICENSE GRANTED 02/22/99

Foreign Priority claimed 35 USC 119 (a-d) conditions met Verified and Acknowledged	☐yes ☐no ☐yes ☐no ☐Met after Allowance Examiner's Initials _____ Initials	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
		FL	0		

ADDRESS

DOCKET ADMINISTRATOR ROOM 3C 512
LUCENT TECHNOLOGIES INC
600 MOUNTAIN AVENUE
P O BOX 636
MURRAY HILL NJ 07974-0636

TITLE

PLANARIZATION TECHNIQUE FOR HDPCVD FSG LAYER

FILING FEE RECEIVED	FEES: Authority has been given in Paper No. _____ to charg /credit DEPOSIT ACCOUNT NO. _____ for the following:	
$150		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of tim) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Abdelgadir 1-17

IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

PROVISIONAL APPLICATION

Mahjoub Ali Abdelgadir
Glenn B. Alers
Joseph William Buckfeller
Jeffrey Devin Bude
Siddhartha Bhowmik
Jane P. Chang
Sundar Srinivasan Chetlur
James Theodore Clemens
Philip W. Diodato
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Gregg Sumio Higashi
Isik C. Kizilyalli
James Joseph Krajewski
Michael Manfra
Marco Mastrapasqua
Alvaro Maury
Martin G. Meder
Sailesh Mansinh Merchant
Donald Winslow Murphy
Loren Neil Pfeiffer
Michael Louis Steigerwald
Hem M. Vaidya
Kenneth William West
Yiu-Huen Wong
Susan M. Zahurak

Case: 1-17

Title: Planarization Technique For HDPCVD FSG Layer

COMMISSIONER OF PATENTS AND TRADEMARKS
WASHINGTON, D. C. 20231

PROVISIONAL APPLICATION COVER SHEET

SIR:

This is a request to file a Provisional Application under 37 CFR 1.53 (c).

[X] 25 number of pages in Specification
[ ] _____ sheet(s) of drawing(s)
[ ] Assignment (this should appear on transmittal letter if the assignment is filed).
[ ] The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
- ☐ No
- ☐ Yes, the name of the U. S. Government agency and the Government contract numbers: _____

Inventor (s): (Full name and address)

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23. Kenneth William West, 45 Corey Lane, Mendham, New Jersey 07945
24. Yiu-Huen Wong, 160 Woodland Avenue, Summit, New Jersey 07901
25. Susan M. Zahurak, RD #3, Box 1300 Boltz Lane, Lebanon, Pennsylvania 17046

Please file the application and charge **Lucent Technologies Deposit Account No. 12-2325** the amount of **$150.00**, to cover the filing fee. Duplicate copies of this letter are enclosed. In the event of non-payment or improper payment of a required fee, the Commissioner is authorized to charge or to credit **Deposit Account No. 12-2325** as required to correct the error.

Please address all correspondence to Docket Administrator (Room 3C-512), Lucent Technologies Inc., 600 Mountain Avenue, P. O. Box 636, Murray Hill, New Jersey 07974-0636. However, telephone calls should be made to me at 610-712-7955.

Respectfully,

Martin G. Meder
Attorney for Applicant (s), Reg. No. 34674

Date: 1/26/99

Lucent Technologies Inc.
600 Mountain Avenue (Room 3C-512)
P. O. Box 636
Murray Hill, New Jersey 07974-0636

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Alvaro Maury	407-371-7523	OR-30K2338	538115000	maury@lucent.com
Mahjoub Abdelgadir	407-371-6592	OR-30K2192	538114000	mabdelgadir@lucent.com

IP LAW USE
Design or Process Sess:
Submission N : 11755
Date Received:—
Attorney:

TITLE: "Planarization Technique for HDPCVD FSG Layer"

Problem(s) addressed by the invention:
This invention addresses the problem of using HDPCVD FSG as a low k oxide between metal lines, without running the risk of exposing the metal to potential fluorine attack.

Closest known solution:
N/A

DESCRIPTION OF THE INVENTION, keyed to drawings, sketches, photographs, etc., sufficient to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention.

Summary (30 words or less): The invention consists of depositing the gap fill HDPCVD FSG layer to a thickness at least 2500 Å higher than the metal thickness. This followed by a short CMP step to partially reduce the high oxide peaks, and leav at least 1000 Å on top of the metal. A second undoped dielectric is deposited, an completely planarized by CMP, if so required.

Detailed Description:
Fig. 1 shows a cross-section of the metal level after the gapfill FSG deposition by HDP CVD. The thickness of oxide on top of metal will vary according to metal linewidth, with the wide lines (above a certain dimension) having the full oxide thickne The wafer is then polished using high planarity conditions to remove an equivalen blanket oxide thickness of about 1500 Å. This step reduces significantly the oxide peaks on top of metal, without exposing metal lines. State of the art CMP tools can produce this result consistently in a manufacturing environme After the first CMP step, a second (undoped) oxide layer is deposited, and a second CMP step done to fully planarize the structure. If dumm fill patterns are used at metal photo, the second CMP step may not be necessary.

Advantages:
This technique allows the integration of a low k material without having to use a very thick FSG deposition (which is very expensive).

Commercial product(s) or other applications in which the invention may be used:
Any device manufactured by Lucent ME in which a low k ILD layer is requi

Explain how use of the invention would be detected:
SEM cross-sections would show whether this approach has been used.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

Alvaro Maury _____ date

M. A. Abdelgadir _____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

. Planarization techni... for HDP CVD FSG

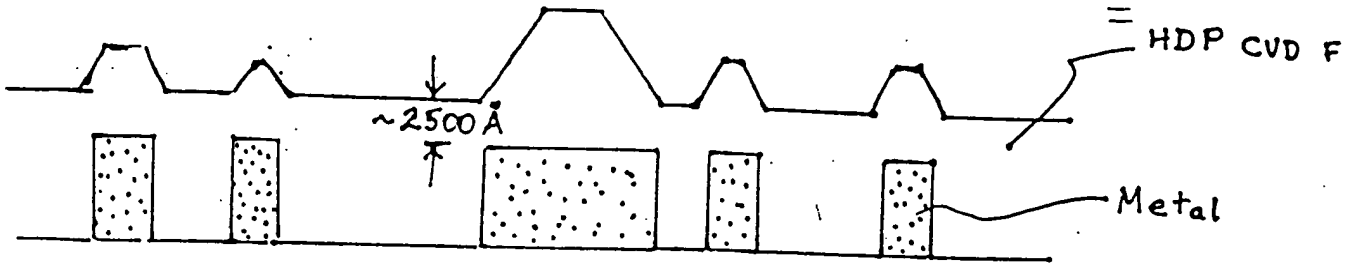


Fig. 1 - After HDP CVD FSG Deposition

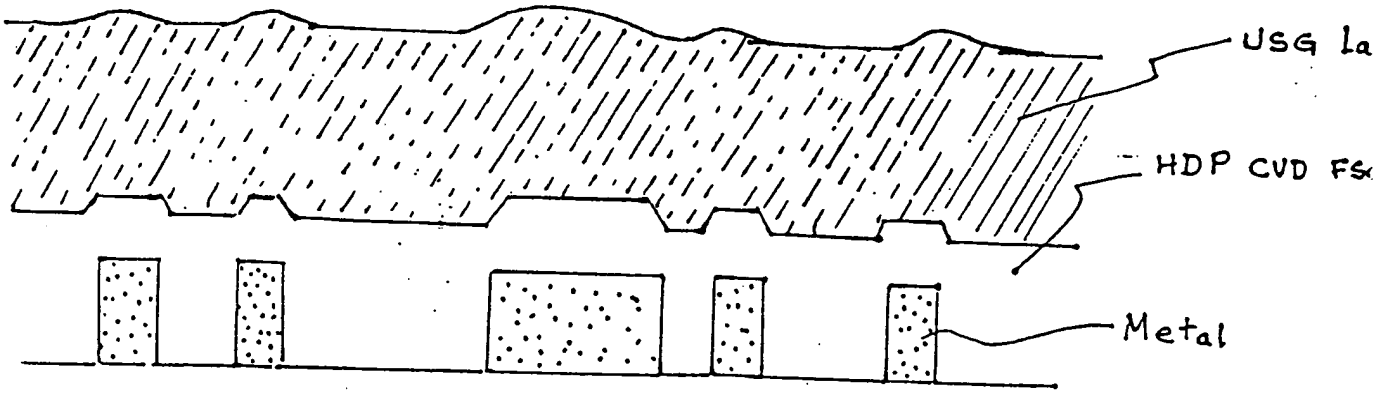


Fig. 2 - After short CMP step, and Undoped Oxide Deposition.

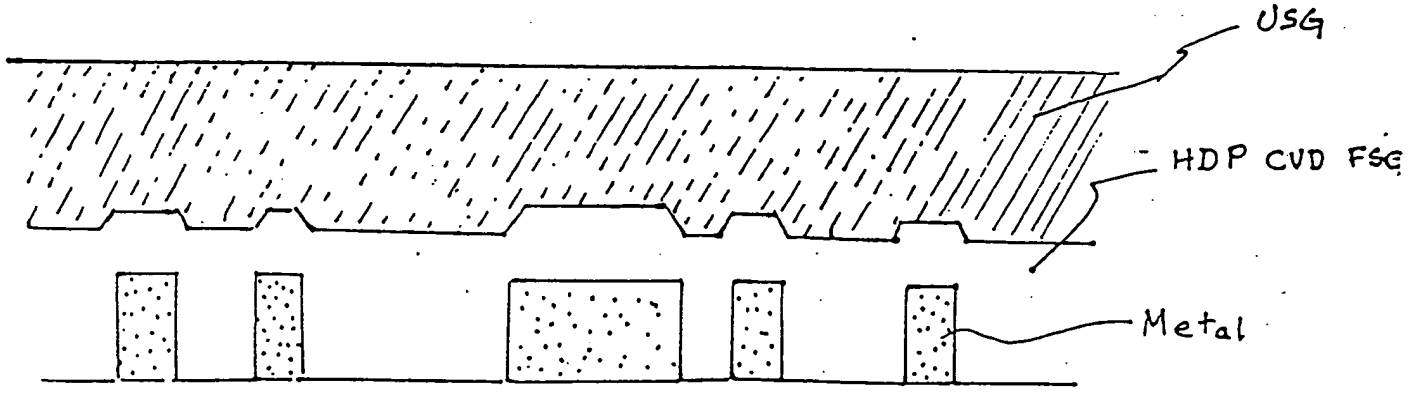


Fig. 3 - After Final CMP on USG Layer

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
I.C. Kizilyalli	407-371-7554	~~2D-219B~~	BL011122 A	ick@cmos
M. Mastrapasqua	908-582-3408	2D-313B	BL011124	mastrapas qua@ lucent

TITLE: Charge Injection Transistor Using High-K Dielectrics.

IP LAW USE
Submission No: 117554
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. Describe the problem your invention solves:

A silicon based negative-differential-resistance transistor is suggested that utilizes a SiO_2/Ta_2O_5 barrier layer.

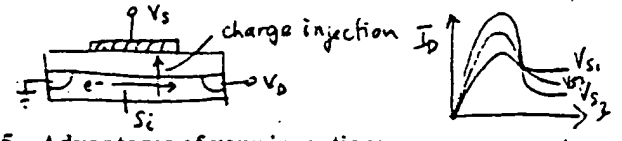
2. Based on information of which you are already aware, describe:
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.

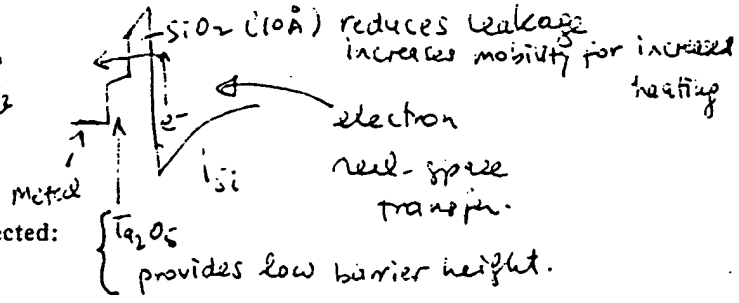
- GaAs-based devices
- Large leakage currents
- Expensive

3. Summarize (30 words or less) the new feature(s) of your invention that solve the problem:

Si/SiO_2/(High-K dielectric) stack is used. Electrons are heated using the source-drain electric field. Charge injection into the poly (or metal) is modified by the S/D voltage. High-K dielectr provides low barr

4. Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.





5. Advantages of your invention:

Si-based NDR device for high frequency applications.

6. Explain how use of your invention would be detected:

SEM

7.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

I.C. Kizilyalli _____ date

_____ date

_____ date

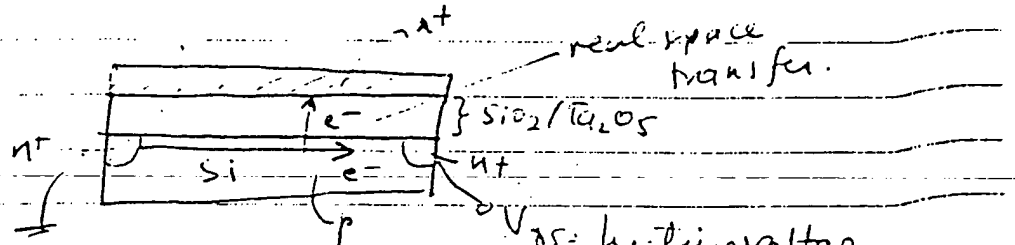
This invention submission has been read and understood by the following two witnesses:

_____ date

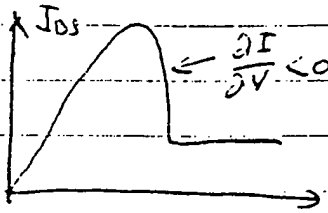
_____ date

Charge Injection Transistor Using Ta_2O_5

Negative differential resistance is achieved through real space transfer of electrons from the Si channel through the SiO_2/Ta_2O_5 gate into the n^+- polysilicon substitute using the S-D voltage and substrate bias. The structure is similar to AlGaAs/GaAs HINTs



Expected Drain current



$\frac{\partial I_D}{\partial V_{DS}} < 0$ ∴ Negative Differential Resistance

Useful for: Si microwave devices

Dit good (28Å) → 17Å

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Glenn B. Alers	(908) 582-4375	MH 3L-302	BL011114-	

TITLE: Sequential Anneal Process For Metal-Oxide-Metal Capacitors

IP LAW USE
Submission No: 117572
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. Problems that is Addressed: Current low temperature anneal processes are not adequate for dielectric films greater than about 20nm.

2. Description of Current Practice: Metal-oxide films (such as tantalum oxide, titanium oxide, aluminum oxide...) can be used to form a capacitor with metal electrodes (such as TiN, TaN, WN, Al) for both sides. However, after deposition, the films must be annealed to improve the dielectric properties. High temperature anneals cannot be used with metal electrodes due to chemical reactions that occur between the electrode and the oxide layer which can decrease capacitance or increase leakage current. An alternate approach is to use a plasma of an oxygen containing gas to anneal the dielectric layer at temperatures less than ~400 C. However, ions from the plasma will not penetrate into the dielectric layer more than roughly 10-20nm. (SIMS data) Therefore, this anneal process is inadequate for films greater than 20nm.

3. Solution to Problem: For dielectric films greater than ~20nm, it is possible to deposit the film in 2-20nm intervals, each thickness interval is followed a plasma process to anneal the thinner film. In this way, films of any thickness can be grown and annealed at the low temperatures required for use with metal electrodes.

4. Present Commercial Practice: Metal oxide films with a thickness of 10nm or less are being used with poly-Si or SiN electrodes and a high temperature (greater than 600 C) anneal step.

5. Explain how use of your invention would be detected: Cluster tools might be marketed with a built in multi-step anneal process.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date
_____ date
_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date
_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Glenn B. Alers	(908) 582-4375	MH 3L-302	BL011114-	

IP LAW USE
Submission No: 117 555
Date Received:
Attorney:

TITLE: Capacitor With Thin Metal Electrodes

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. Problems that is Addressed: Excess surface roughness of the bottom electrode of a metal-oxide-metal capacitor can increase the leakage current for the capacitor.

2. Description of Current Practice: Metal-oxide films (such as tantalum oxide, titanium oxide, aluminum oxide...) can be used to form a capacitor with metal electrodes (such as TiN, TaN, WN, Al) for both sides. To form such a structure, the use of a CVD deposited bottom electrode is desirable because of the enhanced step coverage properties of CVD allow 3 dimensional structures to be used for the capacitor with enhanced area. However, CVD films have a high surface roughness (AFM image). If this roughness is on the order of the film thickness, leakage currents are increased.

3. Solution to Problem: The grain size of the CVD films can be reduced either by (1) Use very think CVD films less than about 20nm thick so that the morphology does not have a chance to form (2) Use a think PVD seed layer to seed smaller grain growth of the CVD film and therefore reduce roughness.

4. Present Commercial Practice: Metal oxide films with a thickness of 10nm or less are being used with poly-Si or SiN electrodes and a high temperature (greater than 600 C) anneal step.

5. Explain how use of your invention would be detected: If a cross section of the capacitor shows a metal layer less than 20nm (seed layer or complete layer) then there is a violation.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date
_____ date
_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date
_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Glenn B. Alers	(908) 582-4375	MH 3L-302	BL011114-	

TITLE: Capacitor With Tungsten Bottom Electrode

IP LAW USE
Submission No: 17557
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. Problems that is Addressed: CVD deposition of metal oxide films (such as tantalum oxide, titanium oxide...) at temperatures higher than ~425 C can form tungsten oxide at the surface (WO_ which is volatile and can lead to adhesion problems between the metal oxide film and the tungston.

2. Solution to Problem: Any combination of the following processes can reduce this problems. (1) Deposit the metal oxide film at less than 425 C to prevent the formation of WO. (2) Treat the tungsten surface to form WN before the metal oxide film is deposited. Possible treatments include plasma process in nitrogen or forming gas or RTA in ammonia.

3. Present Commercial Practice: Metal oxide films with a thickness of 10nm or less are being used with poly-Si or SiN electrodes and a high temperature (greater than 600 C) anneal step.

4. Explain how use of your invention would be detected: SIM analysis that shows the presence of WN at interface.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date

_____ date

_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Glenn B. Alers	(908) 582-4375	MH 3L-302	BL011114-	

TITLE: Capacitor With Amorphous Metal-Oxide Dielectric

IP LAW USE
Submission No: 117558
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. Problems that is Addressed: Morphology change of dielectric layer.

2. Summary of Problem: Current DRAM processes use poly-Si/SiN electrodes with a high temperature anneal step that crystallizes the films. However, when the film crystallizes the surface roughness increases and pin-holes form in the dielectric which can lead to oxidation of the bottom electrode. This roughness increase also limits the minimum thickness of the dielectric film that can be used (one cannot have a thickness less than the roughness).

2. Solution to Problem: Use an amorphous instead of crystalline dielectric layer. If the post processing temperature is kept low then the film can remain amorphous. Alternatively, alloy elements of Al, Ti, Mo can increase the crystallization temperature of the tantalum oxide and will allow thinner films to be used.

3. Explain how use of your invention would be detected: HRTEM cross section analysis.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date

_____ date

_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Gregg Higashi	407-371-7646	OR/30-1E200	538113000	higashi@lucent.com

TITLE: W-Plug Anchor for High-K MOM Capacitors

IP LAW USE
Submission No: 117559
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. Describe the problem your invention solves:
   This invention keeps W-plugs from falling out during MOM capacitor processin
2. Based on information of which you are already aware, describe:
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts:
   There are no other attempts to solve this particular problem that I am aware of.
3. Summarize (30 words or less) the new feature(s) of your invention that solve the problem:
   See attached
4. Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.
   See attached
5. Advantages of your invention:
   Higher capacitance, higher yield
6. Explain how use of your invention would be detected:
   SEM cross-section
7. *** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

Gregg S Higashi _____ date

_____ date

_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

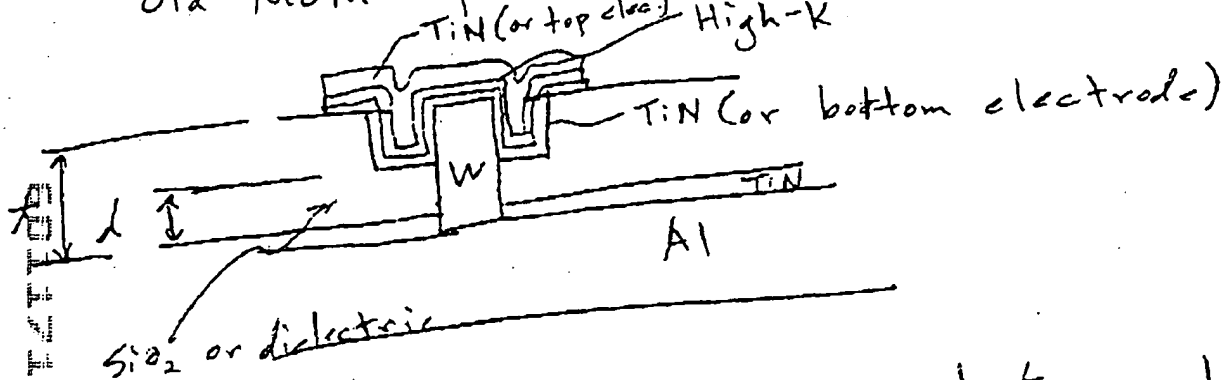
_____ date

3. Summary of invention.

The recessed MOM capacitor structure is limited in depth, and therefore capacitance, by the lifting out of the W-plugs. W-plug anchors solve this problem

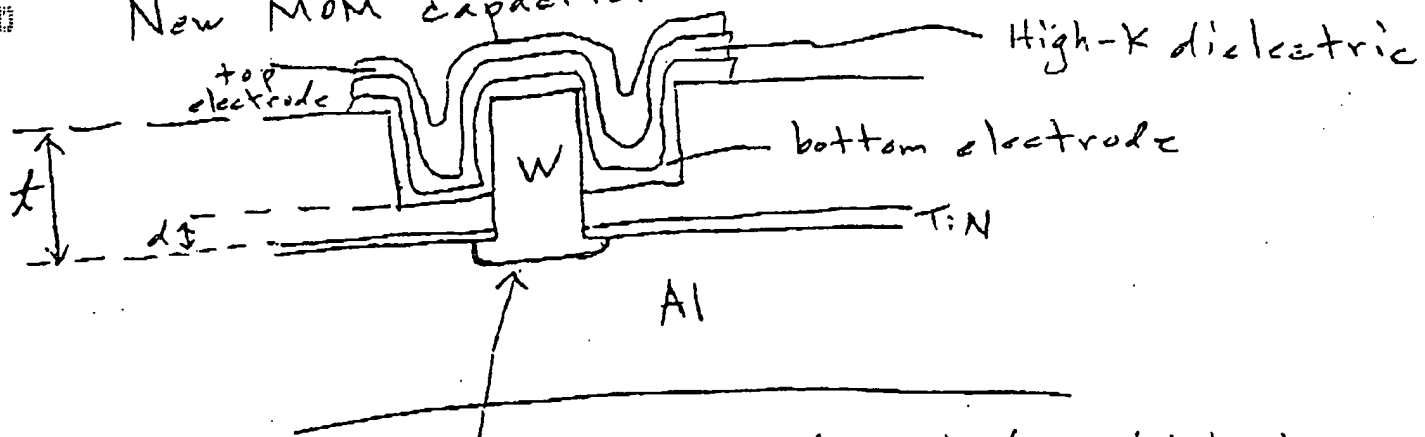
4. Describe invention:

Old MOM capacitor structure



d is typically limited to $\frac{1}{2}t$, where t is the thickness of the dielectric

New MOM capacitor structure



W-plug anchor allows $d < \frac{1}{2}t$ which increases the total capacitance of the bottom electrode, High-K dielectric, top electrode stack.

Old Process

Via Etch

Via Etch Clean

Barrier Dep

W-CVD

⋮

etc

New Process

Via Etch

Via Etch Clean

Isotropic Al etch → (+ clean if needed)

Barrier Dep

W-CVD

⋮

etc

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Y.H. Wong	(908) 582-3919	MH 1A-265	BL011131FD	whywong
D.W. Murphy	(908) 582-2962	MH 1A-263	BL011131A0	dwm

TITLE: Fluorinated Aero-gel for low k Passivation

IP LAW USE
Submission No: 117560
Date Received: _____
Attorney: _____

Important Note: **Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.**

1. **Describe the problem your invention solves:**

   Very low k dielectric

2. **Based on information of which you are already aware, describe:**
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.

   Aero-gel normally is made based on Cl^0 chemistry. By replacing Cl with F, it would be compatible with Cu metallization.

3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**

   Aerogel with F chemistry will passivate Cu as well as Al, which are the metallization scheme for silicon IC. It also has $k < 2$.

4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**

5. **Advantages of your invention:**

   Very low k and form very stable interface to Cu and Al.

6. **Explain how use of your invention would be detected:**

7. *** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date

_____ date

_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Y.H. Wong	(908)582-3779	MH 1A-265	BL0113IF0	whywat
L Pfiefer	(908)582-2710	MH 7A-219	BL0111710	lnp
K. West	(908)582-2060	MH 7A-222	BL0111710	kww
M. Manfra	(908)582-1137	MH 1C-459	BL0111710	manfra

TITLE: Epi-AlN for gate dielectrics

IP LAW USE
Submission No: 117561
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. **Describe the problem your invention solves:**
   Low interface states, high k (~10) and good diffusion barrier to B, P -- etc
2. **Based on information of which you are already aware, describe:**
   (i) **previous attempts to solve the problem your invention solves; and**
   (ii) **the disadvantages of the previous attempts.**
   Good ~~lattice~~ lattice match to Si with epitaxial AlN will lower the interface state density and allow better control, therefore ΔV_{th}.
3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**
   Grow epitaxial AlN on Si by MBE or any other technique.
4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**
5. **Advantages of your invention:**
   see 1.
6. **Explain how use of your invention would be detected:**
7.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date
_____ date
_____ date

This invention ~~submission~~ has been read and understood by the following two witnesses:

_____ date
_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
M. Steigerwald	(908) 582-7491			
Y.H. Wong	(908)582-3979	MH 1A-265	B1011331F0	whyno7
R M. Fleming	(908)582-2911	MH 1D-345	BL011310	mls
S. Zaluzec				

TITLE: PVD of high k with C- and N-based gates

Jane Chang

IP LAW USE
Submission No: 117562
Date Received:
Attorney:

Important Note: **Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.**

1. **Describe the problem your invention solves:**
   Create cabide and/or nitride interface in-situ between high k films and electrodes.
2. **Based on information of which you are already aware, describe:**
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.
   Besides the interfaces, films doped with carbon and nitrogen tend to have lower leakage and better electrical performance.
3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**
4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**
5. **Advantages of your invention:**
   Carbon and nitrogen interface in-situ films graded doping.
6. **Explain how use of your invention would be detected:**
7.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date

_____ / date

_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
J. Bude	(908)582-3615	MH 2D-307B	BL01117S0	bude
S. Merchant				
Y.H. Wong	(908)582-3979	MH 1A-265	BL01131F0	Whynot

TITLE: P. Digital Multi-use MOM

IP LAW USE
Submission No: 17564
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. **Describe the problem your invention solves:**

   Generalized MOM platform for memories, such as SRAM, DRAM, Flash, FeRAM -- even magnetic.

2. **Based on information of which you are already aware, describe:**
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.

   Integrate all the memory functions by appropriate processing and minimum processing steps.

3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**

   High k thin film with the appropriate electrical performance in combination w/ low other dielectric to form MOM capacitors.

4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**

   Standard MOM structure.

5. **Advantages of your invention:**

   Simplicity in design and process, yet flexible in system configuration.

6. **Explain how use of your invention would be detected:**

   SEM's

7.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date

_____ date

_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
S. Merchant				
Y.H. Wong	(408) 582-3919	MH 1A-265	BLO113(FO	whynot
M. Steigerwald	(908) 582-7491	MH 1D-345	BLO113AO	mjs

TITLE: New Geometry Structure / Cu Plug

IP LAW USE
Submission No: 117565
Date Received:
Attorney:

Important Note: **Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.**

1. **Describe the problem your invention solves:**
   Enhance the surface area of Cu plug for higher specific capacitance therefore higher density.
2. **Based on information of which you are already aware, describe:**
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.
   Cu plugs have different structural morphologies as compared to W and Al. Similar method but different chemistry is needed to achieve the goal.
3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**
   Higher density MOM in Cu metallization.
4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**
5. **Advantages of your invention:**
   Higher density memories.
6. **Explain how use of your invention would be detected:**
7.

*** Provide the information requested in this box on each page of the submission as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

Y.-H. Wong _____ date

M. J. Steigerwald _____ date

_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Y.H. Wong	(908)582-3979	MH 1A-265	BL01131F0	Whyhot
M. Steigerwald	(908)582-7491	MH 1D-345	BL01131A0	m/s
S. Merchant	〃			
→ M. Moder				

TITLE: F-passivation of Cu

IP LAW USE
Submission No: 117567
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. **Describe the problem your invention solves:**

   Establish a stable Cu surface for subsequent processing of Cu interconnect.

2. **Based on information of which you are already aware, describe:**
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.

   CuF_2 is extremely stable. We propose ways to achieve it.
   AND CuF ARE

3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**

   Ion implantation, plasma treatment and/or electrochemically treating the Cu with F containing and active species.

4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**

5. **Advantages of your invention:**

   Take full advantage of Cu chemistry.

6. **Explain how use of your invention would be detected:**

7.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

Y.H. Wong — date

M. Steigerwald — date

S. Merchant — date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone N :	Loc/Room	Organization	E-Mail Address
Y.H. Wong	(908)582-3979	MH 1A-265	BLD 1131F0	whynot
M. Steigerwald				
S. Merchant	(908)582-7491	MH 1D-345	BL01131A0	m/s@

TITLE: Surface Modification of Metal Surface

IP LAW USE
Submission No: 117568
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. **Describe the problem your invention solves:**
   Create barrier layer on metal based on the intrinsic chemistry of metal.
2. **Based on information of which you are already aware, describe:**
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.
   Deposit and form with extrinsic film the barrier layer.
3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**
   With techniques such ion implantation, ion sputtering w/wo plasma or chemical treatment (can be electrochemically), inert metal surface results.
4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**
5. **Advantages of your invention:**
   Utilize the properties of the metal to take care of the interface and interdiffusion issues.
6. **Explain how use of your invention would be detected:**
7.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date
_____ date
_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date
_____ date
_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
Y.H. Wong	(908)582-3979	MH 1A-265	BL01131F0	whynot
S. Merchant				
M. Steigerwald	(908)582-7491	MH 1D-345	BL01131A0	m/s @lucat.com
M. Medeiros				

TITLE: Encapsulation of Cu with F-glass.

IP LAW USE
Submission No: 117569
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. **Describe the problem your invention solves:**
   Passivate the surfaces of Cu thin films.
2. **Based on information of which you are already aware, describe:**
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.
   Since CuF_2 is extremely stable and have a strong chemical bond, stable fluorinated glass should be a good match.
3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**
   Similar to SiNH encapsulation for IC devices with Cu interconnect, F-glass is suitable.
4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**
5. **Advantages of your invention:**
   CuF_2 is at least as stable if not better than Cu_xSi_y or Cu_xN_y bonds in Cu encapsulated in SiNH film.
6. **Explain how use of your invention would be detected:**
7.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

_____ date

_____ date

_____ date

This invention submission has been read and understood by the following two witnesses:

_____ date

_____ date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

Name(s) of Submitters	Telephone No:	Loc/Room	Organizati n	E-Mail Address
Y.H. Wong	(908)582-3779	MH 1A-265	BL0 1131F0	Whynot
M. Steigerwald	(908) 582-7491	MH 1B-345	BL01131A0	M/s
J. Krajewski	908 582 2629	MH 1A 374	BL01131A0	JJK@lucent.com
S. Zaffrak	(908)582 3263	MH 1A 376	BL01131A0	

TITLE: Microwave CVD

IP LAW USE
Submission No: 117570
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. **Describe the problem your invention solves:**

   Higher quality CVD films

2. **Based on information of which you are already aware, describe:**
   (i) previous attempts to solve the problem your invention solves; and
   (ii) the disadvantages of the previous attempts.

   Presently CVD films need post-deposition annealing. Microwave plasma is one way to do it. The present technique encompasses both in-situ.

3. **Summarize (30 words or less) the new feature(s) of your invention that solve the problem:**

   It allows in-situ control of gas phase kinetics in the deposition and subsequently treatment of the film.

4. **Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of the invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.**

   Standard CVD chamber with downstream and/or immersed microwave plasma.

5. **Advantages of your invention:**

   Surface preparation, bias and cleanliness.

6. **Explain how use of your invention would be detected:**

7.

*** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

Y.H. Wong — date

M. Steigerwald — date

J. Krajewski — date

This invention submission has been read and understood by the following two witnesses:

[signature] — date

_____ — date

MICROELECTRONICS PATENT COMMITTEE INVENTION SUBMISSION

SONDAR CHOPDAR 407-371-6798 301C-1090 5381620000 schauhan@lucent.com

Name(s) of Submitters	Telephone No:	Loc/Room	Organization	E-Mail Address
PHIL DIODATO	908-582-5588	20-325	BL011240	pwd@lucent.com
HEM VAIDYA	407-371-6645	301W-2208	BL011280	hem@lucent.com
JAMES T. CLEMENS	908-582-2800		BL011280	JTclemens@lucent.com

ALVARO MAURY 407-371-7523 301C-2338 5381500000 amaury@lucent.com

TITLE: Integration on Capacitor in dual damascene advance metallization

IP LAW USE
Submission No: 117571
Date Received:
Attorney:

Important Note: Keep in mind that your submission should be written so it can be understood in 5 to 10 minutes by a generalist. Avoid the use of undefined acronyms and jargon. Keep the language simple.

1. Describe the problem your invention solves:
Increases Capacitor plate area, without increasing memory cell area.

2. Based on information of which you are already aware, describe:
(i) previous attempts to solve the problem your invention solves; and
(ii) the disadvantages of the previous attempts.
In past interlevel dielectric etch back was used to increase surface area of mom capacitor.

3. Summarize (30 words or less) the new feature(s) of your invention that solve the problem:
Please see attached page which describes process flow for new structure.

4. Succinctly describe your invention, referring to drawings, sketches, photographs, etc., in sufficient detail to enable one knowledgeable in the invention's field of technology to understand construction and operation of invention. Drawings, etc., should show only those features necessary for an understanding of the invention. Describe how/why your invention overcomes the disadvantages noted in 2. (ii) above.

5. Advantages of your invention: Due to increase in surface capacitor area, other parameters such as thickness of Ta2O5 film specs can be relaxed.

6. Explain how use of your invention would be detected:
Cross section, TEM, SEM

7. *** Provide the information requested in this box on each page of the submission, as well as drawings, sketches, photographs, etc. ***

Submitter(s) signature(s) and date:

Phil Diodato date

Hem Vaidya date

James Clemens date

Alvaro Maury

This invention submission has been read and understood by the following two witnesses:

date

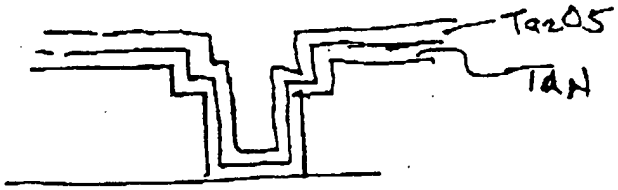
date

(1) D1

(2)

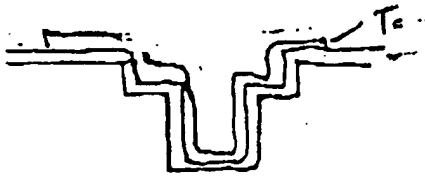
Pattern & ETCH D1 for Dual-Dam for Interconnect

(3)



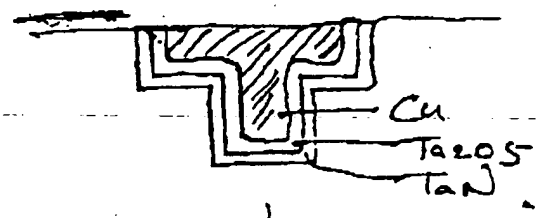
Dep. TaN (Barrier) + Ta2O5

(4)



Pattern & ETCH Ta

(5)



Dep. Cu & CMP.

(6) SPECIAL CLEAN: Remove metal De... for Ta2O5 Inter...

22 PROJECT NAME Submission: 117520 NOTEBOOK NO.

1-15-99 Atty: Martin J. Snider

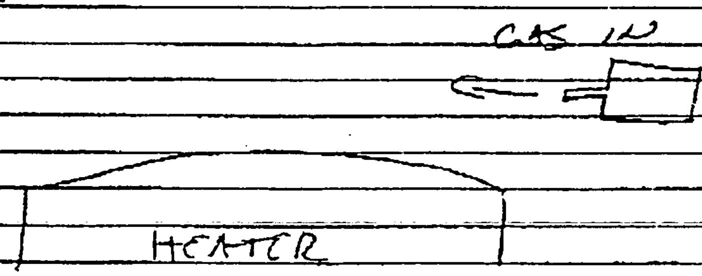
De Control in RF chamber

Buckfeller
Bhowmik
Marchant

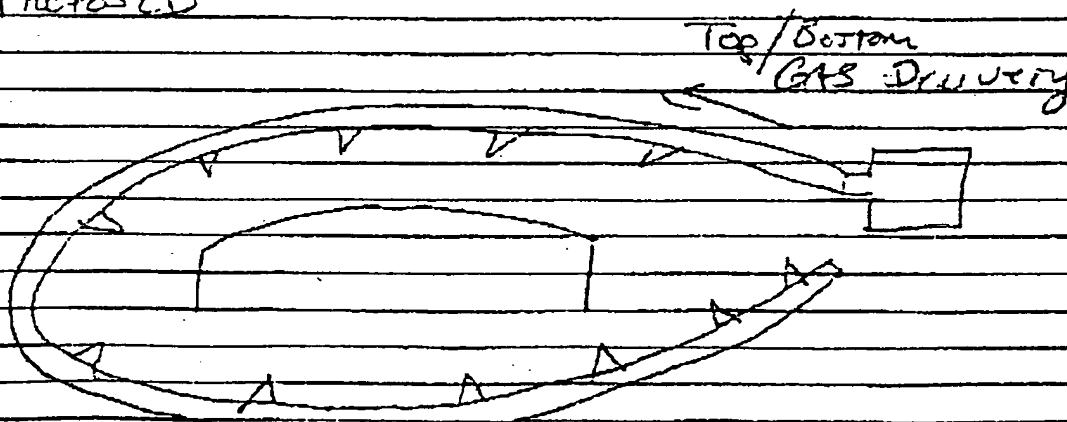
TO GO IN CONJUNCTION WITH PATENT # 116769 - Defect Density Control for RF Etch Chambers

(1) INSTALL SPIDER GAS DELIVERY SYSTEM TO A2 MODULE ON NAUTILUS EQUIPMENT. THIS WILL ALLOW UNIFORM DISTRIBUTION OF THE ARGON GAS FOR RF ETCH. DRWG BELOW

CURRENT



PROPOSED



Page 1 of 2

SIGNATURE ______ DATE ______ 19 ___
READ AND UNDERSTOOD ______ DATE ______ 19 ___

23 PROJECT NAME _____ NOTEBOOK NO. _____

CONTRIBUTERS

Joseph W Bucklew

Joseph W Bucklew
1-15-99

Read and Understood

SIGNATURE _____ DATE _____ 19 _____
READ AND UNDERSTOOD _____ DATE _____ 19 _____

What is Claimed:

1. An integrated circuit and process for making an integrated circuit, substantially as shown and described herein.

PTO/SB/63 (07-03)
Approved for use through 7/31/2003. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

REQUEST FOR ACCESS TO AN ABANDONED APPLICATION UNDER 37 CFR 1.14

Bring completed form to:
File Information Unit
Crystal Plaza Three, Room 1D01
2021 South Clark Place
Arlington, VA
Telephone: (703) 308-2733

In re Application of

Application Number	Filed
60/117,186	1-26-99

Paper No. _____

I hereby request access under 37 CFR 1.14(a)(1)(iv) to the application file record of the above-identified ABANDONED application, which is identified in, or to which a benefit is claimed, in the following document (as shown in the attachment):

United States Patent Application Publication No. _____, page, _____ line _____,

United States Patent Number 6495409, column _____, line, _____ or

WIPO Pub. No._____, page _____, line _____.

Related Information about Access to Pending Applications (37 CFR 1.14):

Direct access to pending applications is not available to the public but **copies** may be available and may be purchased from the Office of Public Records upon payment of the appropriate fee (37 CFR 1.19(b)), as follows:

For **published** applications that are still pending, a member of the public may obtain a **copy** of:
the file contents;
the pending application as originally filed; or
any document in the file of the pending application.

For **unpublished** applications that are still pending:

(1) If the benefit of the pending application is claimed under 35 U.S.C. 119(e), 120, 121, or 365 in another application that has: (a) issued as a U.S. patent, or (b) published as a statutory invention registration, a U.S. patent application publication, or an international patent application publication in accordance with PCT Article 21(2), a member of the public may obtain a **copy** of:
the file contents;
the pending application as originally filed; or
any document in the file of the pending application.

(2) If the application is incorporated by reference or otherwise identified in a U.S. patent, a statutory invention registration, a U.S. patent application publication, or an international patent application publication in accordance with PCT Article 21(2), a member of the public may obtain a **copy** of:
the pending application as originally filed.

Signature

Oct. 22, '03
Date

S. CHAU
Typed or printed name

Registration Number, if applicable

Telephone Number

FOR PTO USE ONLY

Approved by: _____ OCT 22 2003
(initials)

Unit: File Information Unit

This collection of information is required by 37 CFR 1.14. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **BRING TO: File Information Unit, Crystal Plaza Three, Room 1D01, 2021 South Clark Place, Arlington, VA.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

US006495409B1

(12) **United States Patent**
Manfra et al.

(10) **Patent No.: US 6,495,409 B1**
(45) **Date of Patent: Dec. 17, 2002**

(54) **MOS TRANSISTOR HAVING ALUMINUM NITRIDE GATE STRUCTURE AND METHOD OF MANUFACTURING SAME**

(75) Inventors: **Michael J. Manfra**, Short Hills, NJ (US); **Loren N. Pfeiffer**, Morristown, NJ (US); **Kenneth W. West**, Mendham, NJ (US); **Yiu-Huen Wong**, Summit, NJ (US)

(73) Assignee: **Agere Systems Inc.**, Allentown, PA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/472,331**

(22) Filed: **Dec. 23, 1999**

Related U.S. Application Data

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(51) **Int. Cl.**[7] **H01L 21/8238**; H01L 29/76

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(57) **ABSTRACT**

An MOS transistor comprising a substrate, a source, a drain, and a gate, wherein the gate comprises aluminum nitride. Aluminum nitride is epitaxially grown on the silicon substrate at a substrate temperature of about 600° C. and subsequently annealed at a substrate temperature of about 950° C.

30 Claims, 1 Drawing Sheet